UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

itee PhD information technology electrical engineering

DIETI UNINA

# PhD student Riccardo Carbone

# Agile Development for Safety-Critical Software

Tutor: Valentina Casola

Cycle: XXXVII

Year: 1

itee PhD information technology electrical engineering

# My background

- MSc degree: Computer Engineering
- Research group: Seclab
- PhD start date: 01/11/2021
- No scholarship
- Software Embedded Engineer at Rete Ferroviaria Italiana S.p.A. – Research and Development Department (no company funded scholarship)

# Research field of interest

- Critical Software Engineering
  - State of the Art:
    - Software Development Life Cycle has to follow rigorous standards;
    - Standards define SDLC requirements based on a Waterfall model of process (see Fig. 1).
  - Challenges:
    - Management of software requirements changes;
    - Poor customer involvement;
    - Slow feedback for design decisions;
    - Slow innovation of critical systems.
  - Proposals:
    - Agile Hybrid Software Development;
    - Model-Based Software Development.

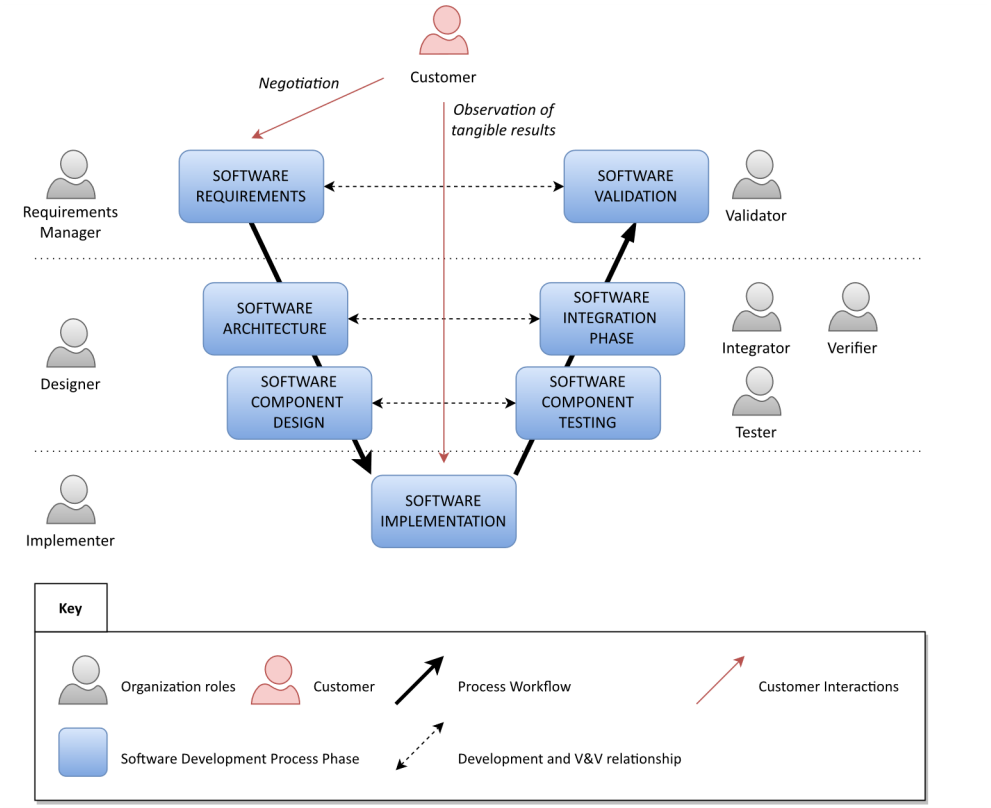


*Fig. 1: The V-Model*

# Summary of study activities

- Ad hoc PhD courses / schools:
  - Virtualization technologies and their applications
  - Statistical data analysis for science and engineering research
  - Innovation management, entrepreneurship and intellectual property
- Seminars:
  - Workshop «La piattaforma ACC di RFI»
  - Introduction to Model Based System Engineering and System Validation with SLRT

# Research activity 1: *"Agile software development for safety-critical systems"*

## 1. Problem

*The waterfall process model is not suitable for the innovation of safety-critical software since the impact of adopting new paradigms or technologies is not predictable.*

## 2. Objective

*Investigate the potential opportunities and challenges of adopting agile methodologies in critical fields.*

## 3. Methodology

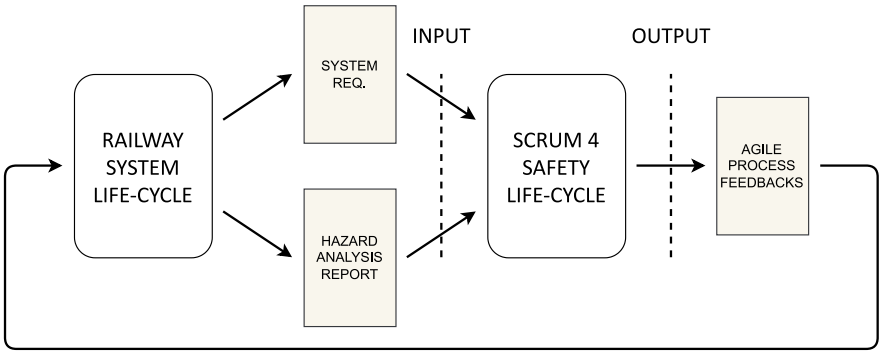


*Fig. 2: Scrum For Safety: Global Perspective*

## 4. Results

*An agile evolutive life cycle helps:*

- *reduce software requirements uncertainty working with customers;*
- *decreasing delivery time;*
- *Making developers reactive to software errors.*

*However, guidelines and tools to lightweight check and maintain software quality must be established within the organization to avoid compromising team agility.*

# Research activity: *"SIL4 Middleware for railway signalling applications"*

## 1. Problem

*The design of a distributed signaling infrastructure requires the recurrent management of subsystem replication to check critical outcome variables, safe protocol stacks, and device drivers for communication features.*

## 2. Objective

*Define the requirements and the architecture of a reusable SIL4 Middleware to manage redundancy and communications in RFI railway signaling infrastructures.*

## 3. Methodology

- *The software was defined and developed following the S4S agile software development process.*
- *Next year the software prototype will be used to check conformity with EN 50128.*

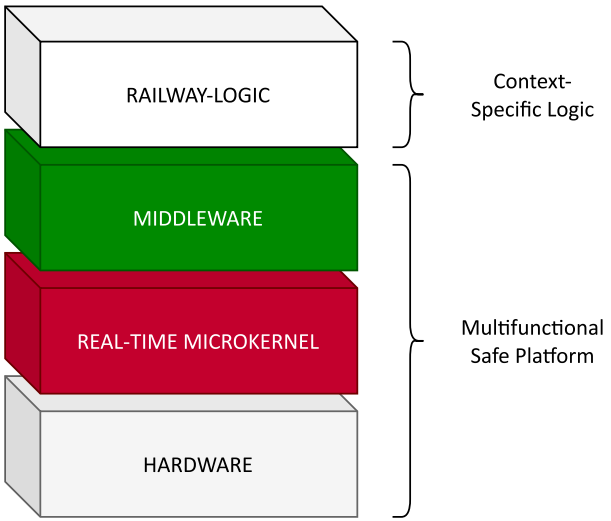


*Fig. 3: Multifunctional platform for railway signaling applications*

# Products for Activity 1

| | |
|---|---|
| [P1] | Journal Article:<br>○ Title: Scrum for safety: an agile methodology for safety-critical software systems;<br>○ Author(s): M. Barbareschi, S. Barone, R. Carbone, V. Casola;<br>○ Journal: Springer - Software Quality Journal (SQJ);<br>○ Current status: published;<br>○ Year: 2022. |
| [P2] | Conference Poster:<br>○ Title: S4S: Agile Methodology Compliant to EN50128;<br>○ Author(s): M. Barbareschi, S. Barone, R. Carbone, V. Casola;<br>○ Conference: International Railway Safety Council (IRSC);<br>○ Year: 2022. |

# Products for Activity 2

| | |
|---|---|
| [P1] | "Specifica dei Requisiti Software del Middleware".<br>• Author(s): M. Barbareschi, S. Barone, R. Carbone, V. Casola, G. Ricci;<br>• Project: RFI SIL4 Platforms;<br>• Current status: under revision;<br>• Year: 2022. |
| [P2] | "Specifica di Design dello strato Middleware".<br>• Author(s): S. Barone, R. Carbone, V. Casola, V. Coppola, S. Della Torca;<br>• Project: RFI SIL4 Platforms;<br>• Current status: under revision;<br>• Year: 2022. |
| [P3] | Middleware Prototype.<br>• Author(s): S. Barone, R. Carbone, V. Coppola, S. Della Torca;<br>• Project: RFI SIL4 Platforms;<br>• Current status: under testing;<br>• Year: 2022. |